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ABSTRACT

These materials were developed for use at the Ocean Institute at Sandy Hook Park in New Jersey. They are used by the students in Brookdale College's Project Impact, an early intervention program for sixth- and seventh- grade students. These activities are designed to help students learn more about the history, geology, biology, and career opportunities associated with the shore. The document includes a Sandy Hook map, the history, a quiz, and suggested activities dealing with the area. A boat trip activity includes general information, safety tips, sailor's superstitions, suggested readings about ships and superstitions, a boat trip data sheet and recording sheet. An activity unit about plankton includes general information, a vocabulary sheet, a worksheet on phytoplankton and zooplankton, and directions for making a plankton net. An activity unit on marshes includes information, vocabulary worksheet, and follow-up activities. Beach activities include a description of creature, arts and crafts, beach profiles, and sand studies. Sand identification, analysis, and comparison sheets are provided. The last activity is a rock identification key. A glossary for terms associated with waves, tides, coastal ecology, and coastal geology is provided. A course evaluation sheet is appended. (KR)

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PROJECT IMPACT

A COMPONENT OF THE CHALLENGE GRANT

SCIENCE AT THE SEASHORE

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by David Grant and Sue Dunker

TABLE OF CONTENTS

	Page
Sandy Hook Map	1
History	2,3,4
Boat Trip	5,6,7,8,9,10
Plankton	11,12,13,14
Marshes	15,16,17,18
Beaches (Creatures)	19,20
(Arts & Crafts)	21,22,23,24
(Profiles)	25,26,27,28,29
(Sand)	30,31,32,33,34,35
Rock I.D.	36
Career Questions	37
Vocabulary	38,39,40,41,42
Evaluation	43

SCIENCE AT THE SEASHORE

By David Grant and Susan Draxler

These materials were developed for use at the Ocean Institute at Sandy Hook Park in New Jersey. They are used by the students in Brookdale College's Project Impact, an early intervention program for sixth and seventh grade students in Monmouth County.

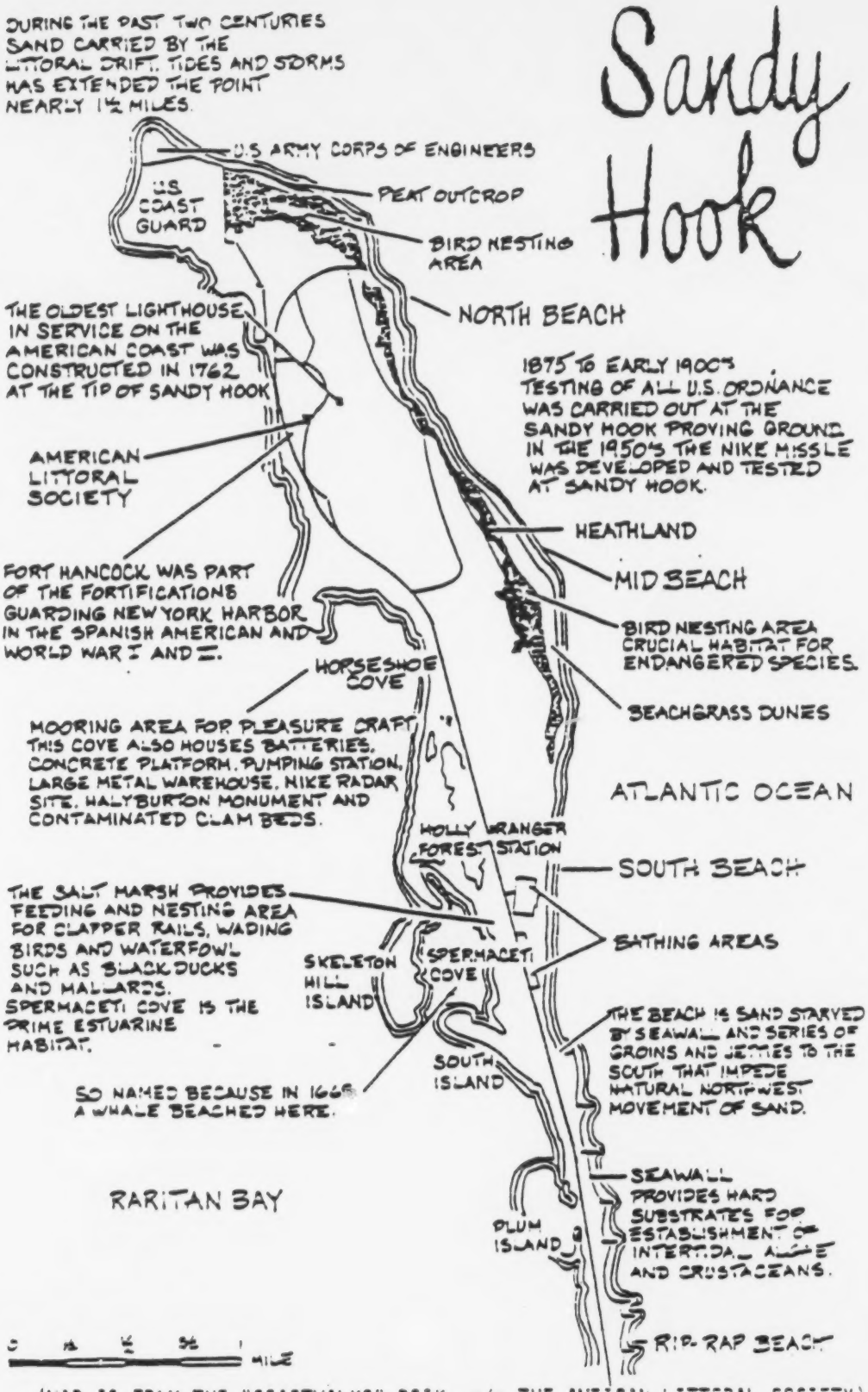
These activities are designed to help students learn more about the history, geology, biology and career opportunities associated with the shore.

Teachers desiring more information or assistance may contact:

David Grant (908-872-2284)

c/o The Ocean Institute/Brookdale College, Box 533, Sandy Hook, NJ 07732

Sandy Hook


DURING THE PAST TWO CENTURIES SAND CARRIED BY THE LITTORAL DRIFT, TIDES AND STORMS HAS EXTENDED THE POINT NEARLY 1½ MILES.
U.S. ARMY CORPS OF ENGINEERS
U.S. COAST GUARD
PEAT OUTCROP
BIRD NESTING AREA
NORTH BEACH
THE OLDEST LIGHTHOUSE IN SERVICE ON THE AMERICAN COAST WAS CONSTRUCTED IN 1762 AT THE TIP OF SANDY HOOK
1875 TO EARLY 1900'S TESTING OF ALL U.S. ORDNANCE WAS CARRIED OUT AT THE SANDY HOOK PROVING GROUND. IN THE 1950'S THE NIKE MISSLE WAS DEVELOPED AND TESTED AT SANDY HOOK.
AMERICAN LITTORAL SOCIETY
HEATHLAND
MID BEACH
FORT HANCOCK WAS PART OF THE FORTIFICATIONS GUARDING NEW YORK HARBOR IN THE SPANISH AMERICAN AND WORLD WAR I AND II.
BIRD NESTING AREA CRUCIAL HABITAT FOR ENDANGERED SPECIES.
HORSESHOE COVE
BEACHGRASS DUNES
MOORING AREA FOR PLEASURE CRAFT. THIS COVE ALSO HOUSES BATTERIES, CONCRETE PLATFORM, PUMPING STATION, LARGE METAL WAREHOUSE, NIKE RADAR SITE, HALYBURTON MONUMENT AND CONTAMINATED CLAM BEDS.
ATLANTIC OCEAN
HOLLY FOREST
RANGER STATION
SOUTH BEACH
THE SALT MARSH PROVIDES FEEDING AND NESTING AREA FOR CLAPPER RAILS, WADING BIRDS AND WATERFOWL SUCH AS BLACK DUCKS AND MALLARDS. SPERMACETI COVE IS THE PRIME ESTUARINE HABITAT.
BATHING AREAS
SKELETON HILL ISLAND
SPERMACETI COVE
THE BEACH IS SAND STARVED BY SEAWALL AND SERIES OF GROINS AND JETTIES TO THE SOUTH THAT IMPEDE NATURAL NORTHWEST MOVEMENT OF SAND.
SOUTH ISLAND
SO NAMED BECAUSE IN 1666 A WHALE BEACHED HERE.
SEAWALL PROVIDES HARD SUBSTRATES FOR ESTABLISHMENT OF INTERTIDAL ALGAE AND CRUSTACEANS.
RARITAN BAY
PLUM ISLAND
RIP-RAP BEACH
0
¼
½
¾
1
MILE

(MAP IS FROM THE "COASTWALKS" BOOK, c/o THE AMERICAN LITTORAL SOCIETY)

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HISTORY

Sandy Hook was destined to play an important part in history because of its nearness to the sea, its strategic location at the mouth of New York harbor and its natural features. The Hook's value has changed with time. Once dreaded as a hazard to navigation, it is now one of New Jersey's most popular vacation areas. Trace Sandy Hook's history backwards using this outline and refer to it on your history tour.

Today-Approximately 300 people live and work at Sandy Hook on a regular basis. Most are associated with the National Park Service, the U.S. Coast Guard, N.O.A.A. and several school groups. Depending on the season 30 thousand daily visitors will stay from one to 24 hours. Most visit in the summer and spend their time sunning, swimming or fishing. However, many thousands also come here in the colder months to hike or relax and enjoy the scenery.

Today Sandy Hook is a park - a National Recreation Area. Since 1973 its 1664 acres have been permanently set aside for all forms of water-oriented recreation, nature study and historical preservation.

1984-The Corps of Engineers completed the dredging of $15,000,000 worth of sand to fill the breach that destroyed the Hook's only access road in October 1982.

1980-(May) Sandy Hook was reopened this week after being closed for almost 6 months for safety reasons. Unexploded ordnance, some of it still live, and weighing up to 1000 pounds, has been surfacing along the beaches where erosion is occurring. The shells are of the 1874-1917 era when the army test fired over three million rounds at its proving grounds here.

1973/74-Military Era ends. National Park Service takes over Sandy Hook.

1950's-Sandy Hook enters the rocket age. Nike anti-aircraft missiles are installed at Sandy Hook to protect New York City.

1941/45-World War II. Population of the Hook is around 17,000 troops. Most stay only a short time for training and processing before being shipped out of Hoboken for Europe.

1917-World War I. Seven thousand troops at the Hook for defense weapons testing and training.

1890's-About 700 troops stationed at Sandy Hook for defense and weapons testing. Troop strength increased during Spanish-American War. New harbor defenses and batteries constructed.

1874-The army designates Sandy Hook as its first official ordnance proving grounds where all of its guns and explosives will now be tested.

1859-Construction begins on a huge granite fort at the tip. This continues during the Civil War. but the fort is never finished. This fort area was surveyed by Capt. Robert E. Lee in the 1840's.

1849-U.S. Life-Saving Service builds station at Spermaceti Cove.

1817-The army buys the southern half of Sandy Hook.

1812-The British navy blockades New York Harbor.

1806-The army buys the northern half of Sandy Hook from the heirs of Richard Hartshorne.

1782-Loyalists depart Sandy Hook for Nova Scotia and the Bahamas, after holding the Hook throughout the war.

1778-(July 5) General Clinton's army of 1,200 evacuates Sandy Hook by ship at Horseshoe Cove after the Battle of Monmouth.

1764-(June 11) Sandy Hook Lighthouse is first lighted.

1678-Richard Hartshorne pays Navesink indians 13 shillings for Sandy Hook.

1677-Richard Hartshorne acquires Sandy Hook and uses it to graze livestock and cut wood.

1600's-Area disputed by British and Dutch

1609-Henry Hudson anchors at Sandy Hook and explores the area of Highlands.

1524-Giovanni Verrazano explores the area.

References: Sandy Hook and The Land of The Navesink - Sam Smith
Nauvoo to the Hook - George Moss

Museum Visit-Use this space for notes about these aspects of Sandy Hook's history...

Aid to Navigation

Life Saving Station

Military Outpost

Proving Grounds

Missile Battery

Recreation Area

QUIZ

1. How high is the Sandy Hook light?
2. How far can it be seen at night?
3. What year was it built?
4. Who was Ft. Hancock named after?
5. What gun is at Sandy Hook?
6. What explorer first sighted Sandy Hook?
7. What British general was forced to evacuate his troops from Sandy Hook?

   a. Washington b. Clinton c. Halyburton d. Lee

8. Who was the person who surveyed Sandy Hook in the 1840's and went on to become a famous general?
9. When was the War of 1812 fought with the British?
10. List two important aspects of Sandy Hook besides its military use.

Suggested Activities

1. Read up on the human history of Sandy Hook. An excellent article on life at the Hook around the turn of the century is:

   "Sandy Hook in 1879"by George Houghton

   It is available at the Sandy Hook Visitor Center and the Twinlights Museum.

2. Pick a time in Sandy Hook's history and write a personal narrative of a person who lived there during that time. Include: who you are; why you were there; what you were doing; and how your life was affected by being there. Title: "A Day in the Life Of...."

3. Write a poem about Sandy Hook's historical features. You might want to chose a particular event or place to write about, or the feelings you have after visiting there. Topics: Ware and Peace, The Ghosts of Fort Hancock, Shipwrecks, The Retreat of the British Army-1778, Indian Life at Sandy Hook.

4. Pick out a famous person whose name is associated with Sandy Hook. Write a short biography of them and see what part of their life was spent at Sandy Hook or involved with it. Suggestions: Verrazano, Hudson, Richard Hartshorne, Penelope Stout, George Washington, General Henry Clinton, Lieutenant Hamilton Halyburton, General Winfield Scott Hancock, Dr. William Newell, Tom Mix. (Sources: Sandy Hook and The Land of The Navesink - SMITH
   Nauvoo to The Hook - MOSS
   Sandy Hook in 1879 - HOUGHTON)

BOAT TRIP

(Please make sure all passengers are aware of regulations)

Information on Boat Trips

General--

-Trips are confined to Sandy Hook Bay, which is usually quite calm.
-Passengers should be prepared for the weather. An extra sweater and a raincoat are recommended.
-All passengers must have a signed Waiver & Release, acknowledging they are going on the vessel. (Parents of minors must be notified.)
-Sneakers are a must. No hard-soled shoes are permitted.

Safety--

-All passengers will be issued U.S. Coast Guard approved Personal Flotation Devices which must be worn if requested by the staff.
-There must not be any running on the boat, dock or in the vicinity of vessel operation. Passengers will confine their activities to the main deck and cabin. Climbing or sitting on ladders and railings is unsafe and not permitted.
-All passengers will remain inside the main cabin while the vessel is docking or departing.
-All passengers will remain forward of the stern-work area when winches or other equipment is in operation.
-No smoking.

Comfort--

-Don't forget lunch and ample refreshments; neither will be provided.
-Don't forget sufficient clothing to stay dry and warm. It is generally windier and cooler at the shore..
-People prone to motion sickness should take the recommended medications well before they are to leave port.
-If seasickness does occur, it is advisable to stay outdoors. Please notify the field trip leader immediately.
-There are limited restroom facilities on the boat. Please plan to use the facilities at Building 22 instead, before or after the boat trip.

One Final Word

The Captain shall have the last word on everything. This includes weather, safety, schedules, discipline,

SAILORS' SUPERSTITIONS

In the days of wooden ships, sailors had many beliefs to explain both good and bad luck. It was important to respect these superstitions or one sailor might, by his actions, jeopardize the whole ship. A "jonah" was someone who was responsible for the bad luck on a ship. If the crew discovered that a jonah was aboard, he would quickly be set adrift in a small boat with some water and provisions. The crew felt this precaution was necessary to protect the safety of the ship.

Here are some omens that would surely bring bad luck if they weren't heeded. A ship will have trouble aboard...

- -if someone hammers nails on Sunday.
- -if someone spills paint on the deck.
- -if a large bird lands on the ship.
- -if a mirror is broken before sailing.
- -if the anchor line becomes so tangled that it has to be straightened out before it can be used.
- -if you set sail on a Friday.
- -if a passenger brings aboard any unusual luggage.
- -if women or clergymen are passengers.
- -if any crewman can swim.

Can you think of some ways that these superstitions could have evolved? Do you think that there could be any truth to any of them?

Here are some other strange beliefs about the sea...

Mermaids - Some sailors feared that if any crewman saw a mermaid the ship would be lost with all hands.

Sharks - If a shark follows a ship, a passenger or crew will soon die.

Clergy - Since the devil hates clergymen and he will do anything to harm them, a ship that carries one is in certain danger.

Porpoises - If a sailor kills a porpoise, even by accident, he will have bad luck for the rest of his life.

Birds - If a Storm Petrel lands on the ship, a storm will soon begin. If a Storm Petrel or Albatross is killed by a sailor, it will bring bad luck to the ship.

There were good omens and beliefs too. Here are a few...

-If a small bird or bee lands on the ship before it sails, the voyage will be safe and prosperous.

-Tatoos on a sailor are considered good luck charms and help insure a safe voyage.

-Porpoises are a sailor's best friend. They will guide ships out of danger, protect sailors from sharks and rescue drowning victims by pushing them ashore.

-If a sailor dies at sea, his spirit remains with the ship and his shipmates. He can reappear at times to warn his crewmates of impending dangers.

MORE SEA STORIES

Discipline is very important on a ship, especially on long voyages. Keel-hauling was the punishment for mutineers in the 1700's and early 1800's, and was usually fatal. A mutineer was dragged under the hull and oftentimes bled to death from the cuts be received from the barnacles growing on the keel.

Whistling on sailing ships was not permitted because it could be confused with the captain's orders that were given by the boatswain on his "bosun's" whistle. Its shrill sound could be heard even when a strong gale was blowing and the ship was creaking and straining. However, when the ship was becalmed, everyone was expected to whistle. Hopefully this would get the attention of St. Anthony, who would send fair sailing winds.

Early sailors made animal sacrifices to the gods to ask for protection from all the dangers of the sea. Today that tradition still survives. Modern boat builders "sacrifice" a bottle of the finest spirits by smashing it across the bow of a ship at launching. This is done to insure good luck.

So you see, even today we're a little superstitious when it comes to ships and sailing the wide oceans. Some interesting reading about ships and superstitions:

The Rhyme of The Ancient Mariner

The Flying Dutchman

The Bermuda Triangle (by Charles Berlitz)

Sailing Alone Around The World (by Joshua Slocum)

The Book of The Sea (by A. C. Spectorsky)

The Mystery of The Mary Celeste

BOAT TRIP DATA SHEET

Vessel_____ Length_____ Port_____

Date_____ Sailing Time_____ Return Time_____

METEOROLOGICAL DATA

Wind: Direction_____ Speed_____ Time_____ Elevation_____

Air Temperature_____ Barometer_____

Clouds: Type_____ Percent Cover_____

Description of Weather_____

_____

SEA SURFACE CONDITIONS

Sea State_____ Swell: Height_____ Period_____

Stage of Tide_____ Predicted High Tide_____

Surface Current: Velocity_____ Direction_____

WATER SAMPLING DATA

Site 1 Surface: Temp._____	Salinity_____	pH_____	D.O._____
Site 1 Bottom: Temp._____	Salinity_____	pH_____	D.O._____
Site 2 Surface: Temp._____	Salinity_____	pH_____	D.O._____
Site 2 Bottom: Temp._____	Salinity_____	pH_____	D.O._____
Site 3 Surface: Temp._____	Salinity_____	pH_____	D.O._____
Site 3 Bottom: Temp._____	Salinity_____	pH_____	D.O._____
Site 4 Surface: Temp._____	Salinity_____	pH_____	D.O._____
Site 4 Bottom: Temp._____	Salinity_____	pH_____	D.O._____
Site 5 Surface: Temp._____	Salinity_____	pH_____	D.O._____
Site 5 Bottom: Temp._____	Salinity_____	pH_____	D.O._____

BOTTOM SAMPLING

Site 1 Bottom Type: Rock/Gravel/Sand/Mud
Depth_____ Organisms_____

Site 2 Bottom Type: Rock/Gravel/Sand/Mud
Depth_____ Organisms_____

Site 3 Bottom Type: Rock/Gravel/Sand/Mud
Depth_____ Organisms_____

Site 4 Bottom Type: Rock/Gravel/Sand/Mud
Depth_____ Organisms_____

Site 5 Bottom Type: Rock/Gravel/Sand/Mud
Depth_____ Organisms_____

BOAT TRIP RECORDING SHEET

SITE_____
SURFACE
Temp___
Sal ___
pH ___
D.O.___

SITE_____
SURFACE
Temp___
Sal ___
pH ___
D.O.___

SITE_____
SURFACE
Temp___
Sal ___
pH ___
D.O.___

SITE_____
SURFACE
Temp___
Sal ___
pH ___
D.O.___

10

SITE_____
DEPTH_____
Temp___
Sal ___
pH ___
D.O.___

SITE_____
DEPTH_____
Temp___
Sal ___
pH ___
D.O.___

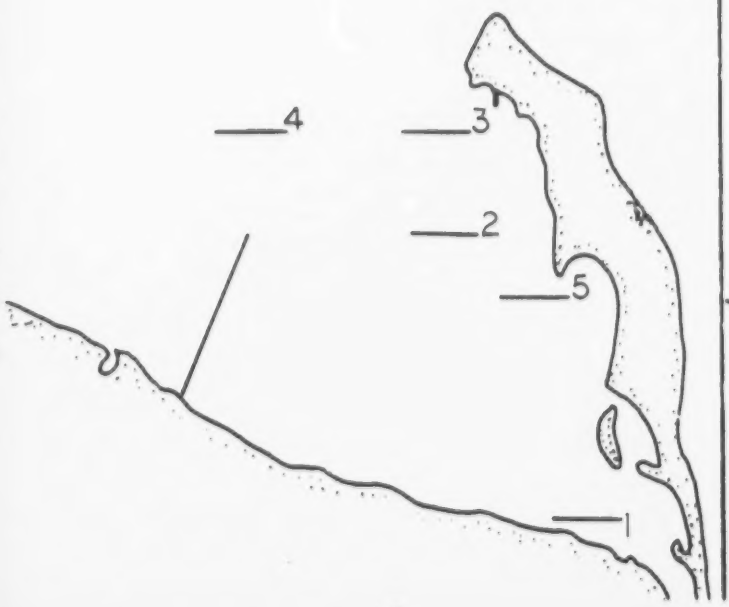
SITE_____
DEPTH_____
Temp___
Sal ___
pH ___
D.O.___

SITE_____
DEPTH_____
Temp___
Sal ___
pH ___
D.O.___

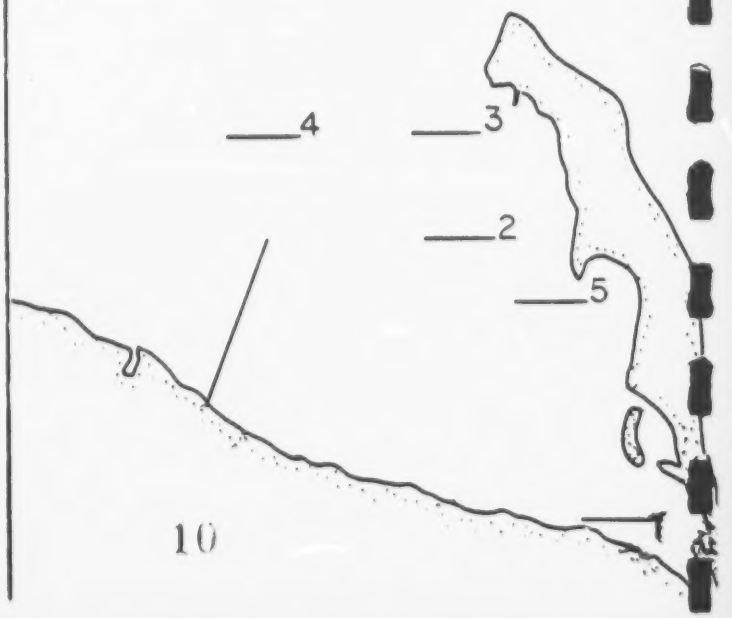
50

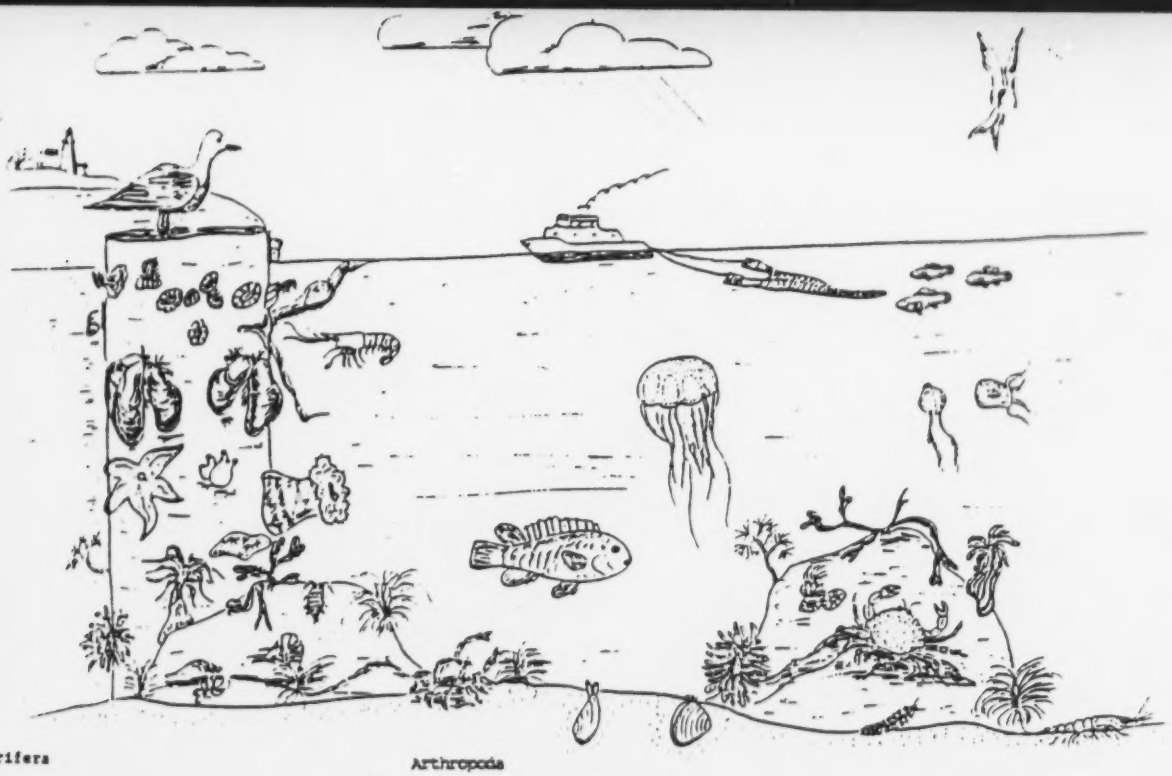
Bottom_____ Bottom_____ Bottom_____ Bottom_____

SURFACE TEMPERATURES



SURFACE SALINITIES





Porifera

___ 1. Sulfur Sponge
___ 2. Red beard Sponge

Coelenterata

___ 3. Snail Fur
___ 4. Sea Nettle
___ 5. Lion's Mane
___ 6. Sea Anemone
___ 7. Star Coral

Ctenophora

___ 8. Sea Gooseberries
___ 9. Slipper Comb Jelly

Bryozoa

___ 10. Bugula
___ 11. Sea Mat

Molluscs

___ 12. Hard Clam
___ 13. Soft Clam
___ 14. Oyster
___ 15. Blue Mussel
___ 16. Ribbed Mussel
___ 17. Oyster Drill
___ 18. Moon Snail
___ 19. Mud Snail
___ 20. Periwinkle
___ 21. Common Slipper Shell
___ 22. Flat Slipper Snail
___ 23. Basket Shell

Annelida

___ 24. Blood Worm
___ 25. Sand Worm
___ 26. Bristle Worm

Arthropoda

___ 27. Rock Crab
___ 28. Calico Crab
___ 29. Spider Crab
___ 30. Hermit Crab
___ 31. Mud Crab
___ 32. Blue Crab
___ 33. Sand Shrimp
___ 34. Grass Shrimp
___ 35. Skeleton Shrimp
___ 36. Squid
___ 37. Lobster
___ 38. Horseshoe Crab
___ 39. Barnacle

Echinodermata

___ 40. Starfish

Urochordata

___ 41. Sea Squirt

Chordata

___ 42. Fluke
___ 43. Flounder
___ 44. Window Pane
___ 45. Cunner
___ 46. Blackfish
___ 47. Bluefish
___ 48. Porgy
___ 49. Spot
___ 50. Silverside
___ 51. Anchovy
___ 52. Ling
___ 53. Whiting
___ 54. Puffer
___ 55. Sea Bass
___ 56. Weakfish
___ 57. Herring
___ 58. Menhaden
___ 59. Toadfish
___ 60. Sea Robin
___ 61. Sea Horse
___ 62. Eel
___ 63. Dogfish

Birds

___ 63. Herring Gull
___ 64. Black-backed Gull
___ 65. Laughing Gull
___ 66. Cormorant

Plants

___ 67. Sea Lettuce
___ 68. Pop Weed
___ 69. Red Rock Weed
___ 70. Eelgrass

ADDITIONAL SPECIMENS

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Marinelife can be divided into three groups according to such things as their lifestyle, locomotion or habitat.

These are: Benthos - bottom dwellers like crabs, barnacles, burrowing worms, seaweeds, etc.
Nekton - swimming creatures like fishes, squids, whales and seals.
Plankton - free floating creatures that drift with the currents.

The word plankton comes from the same Greek word as planet and means drifter. Plankton can come in many sizes, but most are tiny. Many familiar creatures like fishes, crabs, barnacles, worms and mollusks spend the first few days or weeks of their lives in a planktonic stage.

Plankton can be divided into two groups: Phytoplankton - Plants
Zooplankton - Animals

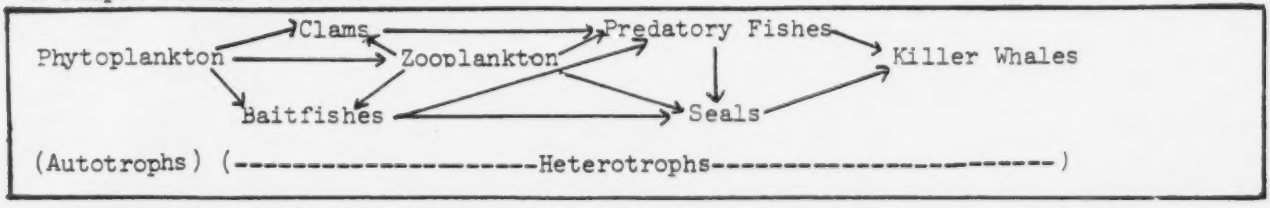
Plankton are the most important creatures in the sea. Phytoplankton are producers (autotrophs) and use sunlight for photosynthesis to grow. Zooplankton are consumers or grazers (heterotrophs) and feed on phytoplankton.

Both groups are eaten by larger consumers like fishes, clams and even whales. Most life in the sea relies directly on tiny plankton for food, or indirectly on plankton grazers.

A simple marine food chain is:

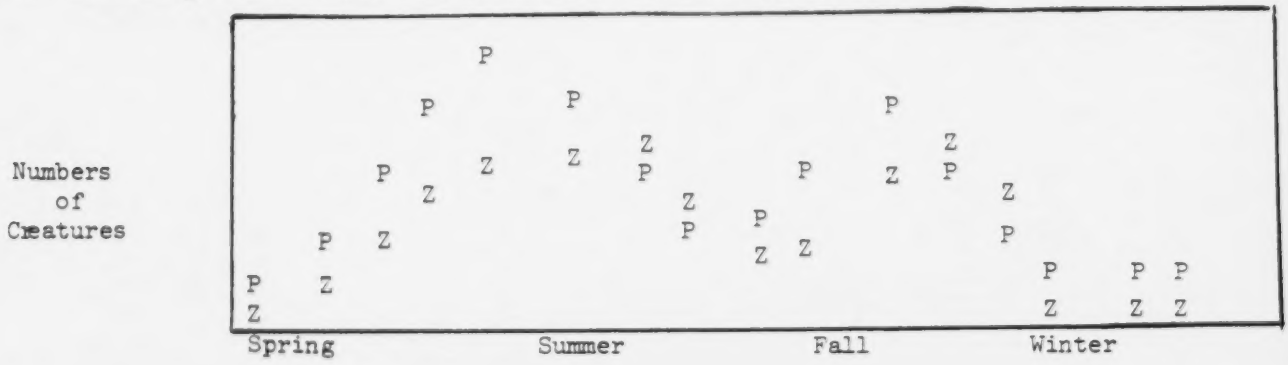
Phytoplankton → Zooplankton → Bait fishes → Predatory fishes → Seals
(Autotrophs) (----------Heterotrophs----------)

A simple marine food web is:



All marinelife relies on phytoplankton to capture the sun's energy and produce food from it.

Phytoplankton need sunlight, fertilizer (nutrients) and adequate water temperatures for maximum growth. These conditions occur in the spring and fall.



Connect the P's (Phytoplankton) with a dotted line and Z's (Zooplankton) with a solid line to illustrate their abundance throughout the year.

Zooplankton need phytoplankton to feed upon, so their population curve must follow the phytoplankton population curve.

VOCABULARY

Autotroph _____

Benthos _____

Food Chain _____

Food Web _____

Heterotroph _____

Nekton _____

Nutrients _____

Photosynthesis _____

Phytoplankton _____

Plankton _____

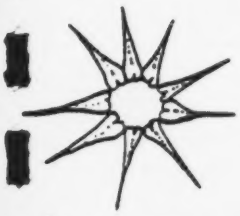
Population Curve _____

Zooplankton _____

SPECIMEN OBSERVATIONS

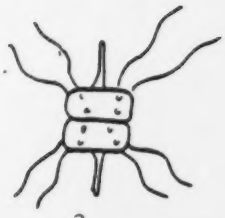
Specimen 1	Specimen 2
Specimen 3	**Specimen 4**

PHYTOPLANKTON



1. _____

2. _____



3. _____

4. _____

5. _____

6. _____

7. _____

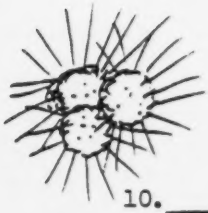
8. _____

9. _____

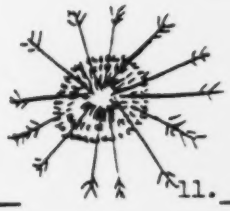
PHYTOPLANKTON

1. Asterionella
2. Coscinodiscus
3. Thalassiosira
4. Rhizosolenia
5. Navicula
6. Ceratium
7. Ceratium
8. Gonyaulux
9. Noctiluca

ZOOPLANKTON



10. _____



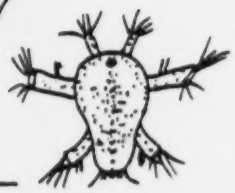
11. _____

12. _____

13. _____

14. _____

15. _____



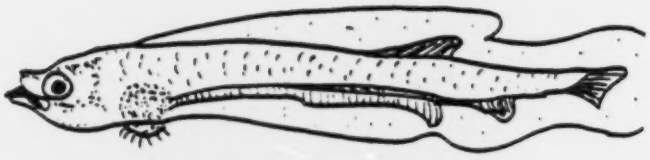
16. _____

17. _____

18. _____

19. _____

20. _____



21. _____

ZOOPLANKTON

10. Globigerina
11. Radiolarian
12. Tintinnid
13. Mollusk larva
14. Worm larva
15. Starfish larv
16. Barnacle larv
17. Crab larva
18. Copepod
19. Starfish lar
20. Fish eggs
21. Fish larva

Homemade Plankton Net
by David Grant

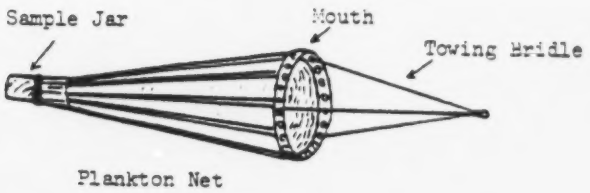


Fig. I

A small commercial plankton net can cost $25.00 or more, but a homemade net can be built using everyday materials and is even sturdy enough to tow behind a boat.

You will need: Fishing line - as a towing bridle.
Chlorox bottle section - as support (the top half of the Bottle makes a great water scoop too!)
Stocking - for a sturdy, fine-mesh net.
Duct tape - to secure the stocking to the Chlorox bottle.
Plastic medicine bottle - inserted inside the stocking as a sample jar.
Rubber bands - to secure the medicine bottle.

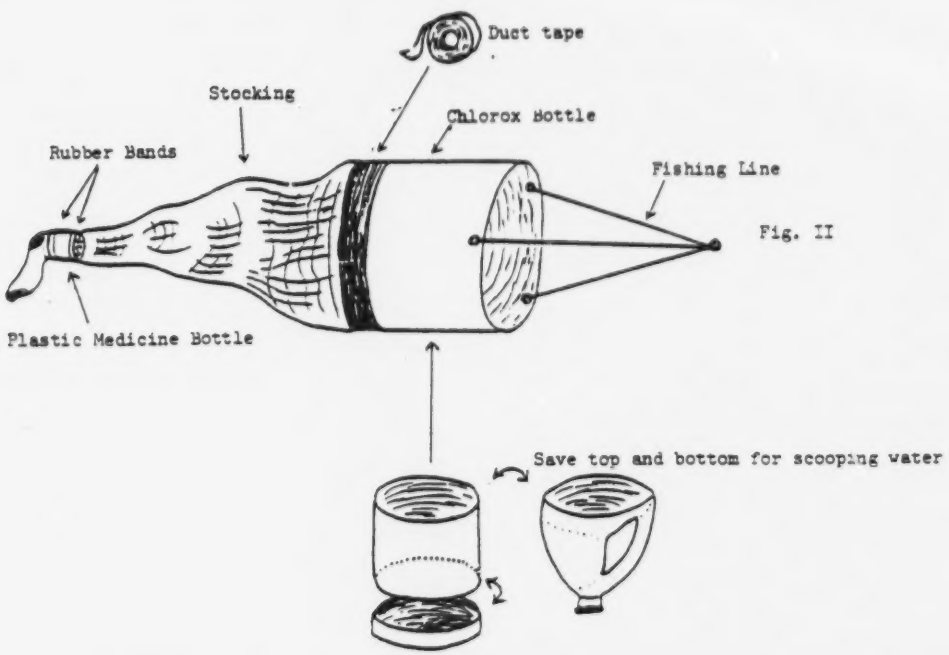


Fig. II

Tow your net very slowly, or pour water through it gently and it will work better and last longer. Don't use it in creeks or currents if there are snags that might tear the stocking. Scoop the water instead.

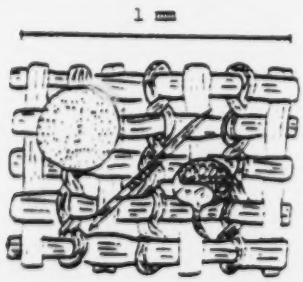
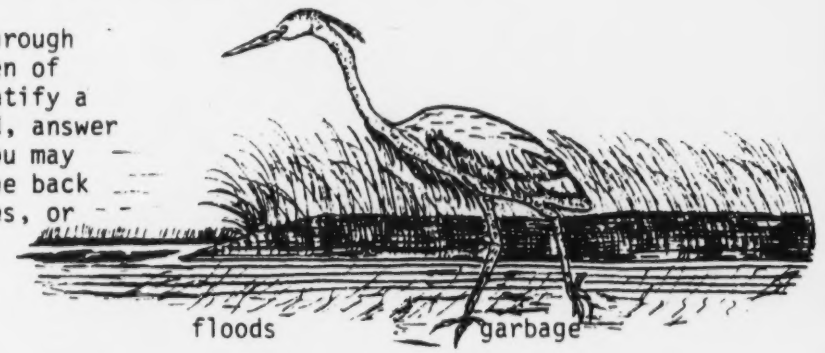


Fig. III

Plankton drawn to scale as they appear in the net.

HOW HARSH IS THE MARSH?

Take a few minutes and read through the following words. Check ten of those that you think best identify a marsh. Once you have finished, answer the questions that follow. You may use your vocabulary list in the back of the book to find definitions, or skip words you don't know.



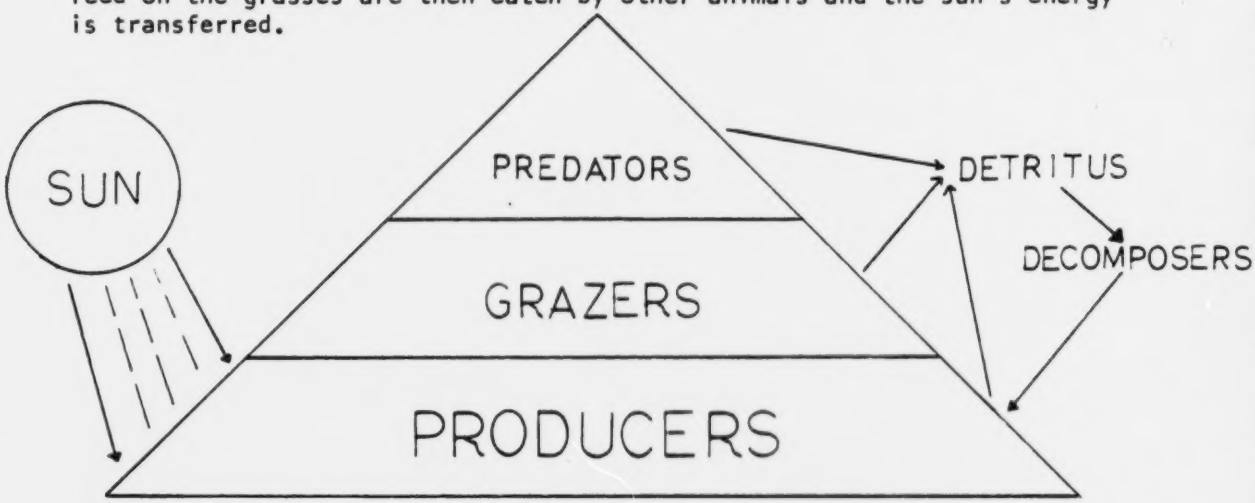
water	food	floods	garbage
land	crabs	friendly	flat
tide	filter	beautiful	important
ebb	hydrogen - H	fun	flies
flow	fishes	nitrogen - N	clams
resource	spartina	nursery	production
salty	rotten	hostile	element
mud	education	grass	mussels
sea	eggs	wind	estuary
air	sulfur - S	resource	odor
sunlight	dry	seaweed	photosynthesis
plants	carbon - C	acre	life
nutrients	birds	phosphorous - P	fishing
sand	recreation	creek	wood
detritus	oxygen - O	currents	people
decay	worms	mosquito	scientific
pollutant	plankton	wastes	awful
pollution	ugly	calm	wild
storms	turtles	fresh	gentle
organic	energy	inorganic	erosion

WHAT IS A MARSH? WHY IS IT IMPORTANT?

A marsh can be different things to different people. Some people like marshes because they think they are pretty. Scientists study marshes because many valuable plants and animals are found there. Fishermen and hunters stalk game in marshes because many fishes and birds feed there. Farmers even harvest grass from marshes to feed cattle. Marshes can be valuable land because so many people like to live near the water. Some people think marshes are bad because they smell and mosquitoes breed in them. What is a marsh and why is it important?

A MARSH IS... a low, wet, grassy area that is frequently covered by water. There are fresh-water marshes, but the most important ones are salt-water marshes that are washed by the tides... TIDAL MARSHES. When the tide rises - or floods - fishes, crabs and other creatures enter the marsh and search for food. As the tide recedes - or ebbs - these creatures move back to the creeks that meander through the marsh. The tidal currents

A MARSH IS... a food factory. The spartina grasses that grow there produce ten tons of nutrients (leaves, stems) per acre. This is seven times more than a corn field produces. The sun gives the grasses the energy they need for photosynthesis to produce more leaves and stems. Animals that feed on the grasses are then eaten by other animals and the sun's energy is transferred.



A marsh might have over 40 million fishes, snails, clams, crabs, insects and other creatures living on each acre. Most of the fishes along our coast (70%) rely on marshes for feeding, spawning and growing.

A MARSH IS... a nutrient "bank". Nutrients and elements like nitrogen, phosphorous, sulfur and carbon are stored and used there. They are trapped in the detritus of the marsh (dead plants and animals and their wastes).

A MARSH IS... a sponge for flood waters. Its low, flat surface holds water during storms and releases it slowly afterward. Marshes protect the land during storms.

A MARSH IS... nature's sewage treatment plant. An acre of marsh can purify the wastewater from several homes (20 people).

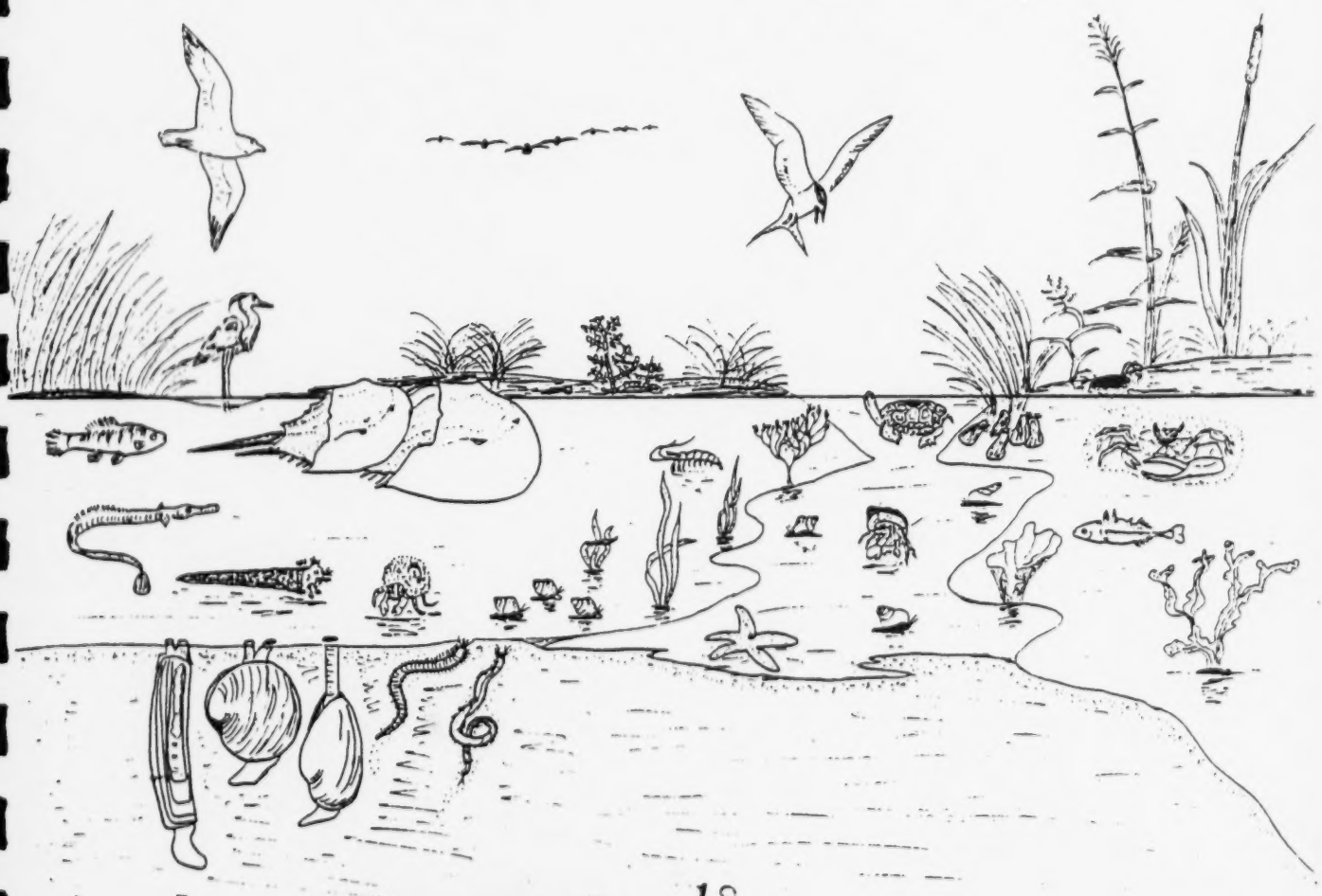
A MARSH IS... delicate. Its soft muds are easily disturbed by human activities. This can kill the sensitive plants and animals that live there.

A MARSH IS... fascinating. Scientist study marshes because they are unique, full of many creatures, and more valuable (productive) than all other areas. Marshes smell because they are full of life.

A MARSH IS... fun. Sportsmen fish and hunt around rich marsh areas. Bird watchers find fascinating and abundant wild life there. Artists find beauty there.

What else is a marsh?_____

_____



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FOLLOW UP ACTIVITIES

After visiting and studying the marsh, choose one of the activities to work on at home. This will remind you of your trip to this special place.

1. a - An acre is equal to approximately 40,000* square feet. Calculate the number of fishes, crabs, shrimp, snails and clams that might be found in 10 acres of marsh.

   b - Calculate the number of animals for each square foot of marsh.

   c - Calculate the number of animals for each square inch of marsh.

   d - Calculate how many acres of marsh would be needed to purify the wastewater of a town of 20,000 people.

2. Think about the marsh you have just visited and the creatures you saw there. Write a poem about a creature you studied. Imagine yourself as that creature.

   Here's an example:

Choose a word to describe yourself.	BIRD
Write two words that describe your appearance	BOLD, GRAY
Next write three words that describe how you live or where you live	GLIDING, DIVING, CHASING
Then, two words describing your function in the environment	SCAVENGER, PREDATOR
Finally, what you are	SEAGULL

*Exact figure is 43,560 square feet

COASTAL CREATURES

Animals with a backbone

1. _____
2. _____
3. _____
4. _____

Animals without a backbone

5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
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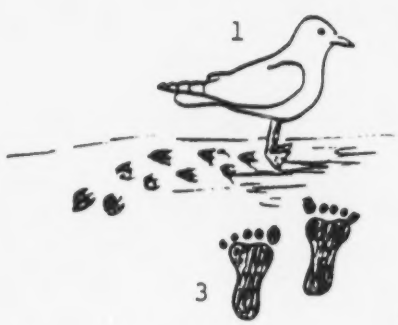
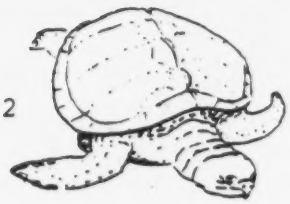
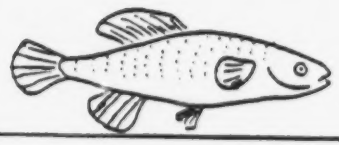
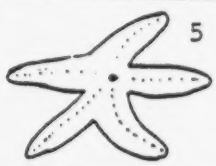
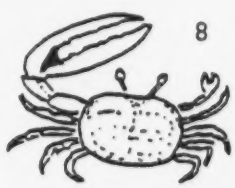
17. _____
18. _____
19. _____
20. _____
21. _____

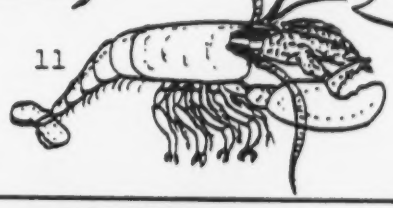












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VERTEBRATES

1. Bird
2. Reptile
3. Mammal
4. Fish

INVERTEBRATES

Spiney-skinned animals

5. Starfish
6. Urchin
7. Sand Dollar

Jointed-footed animals

8. Fiddler crab
9. Horseshoe crab
10. Barnacle
11. Lobster
12. Mole crab

Mollusks

13. Razor clam
14. Hard clam
15. Whelk
16. Snail

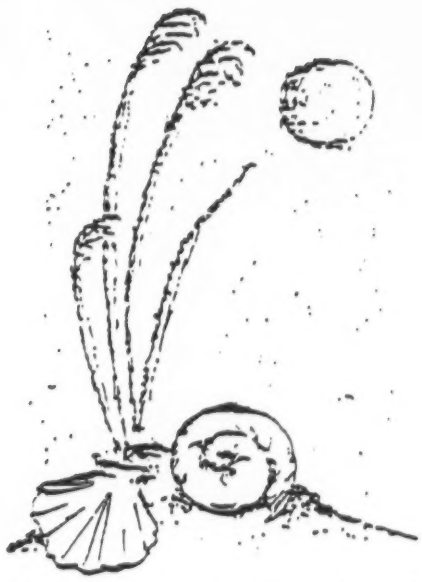
Segmented worms

17. Sand worm

Corals and Sponges

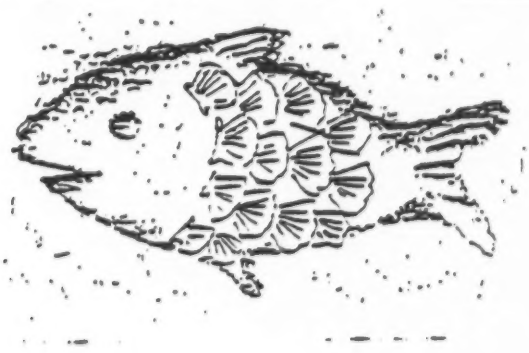
18. Jelly fish
19. Anemone
20. Star coral
21. Dead man's fingers sponge

Sand Casting



You will need:

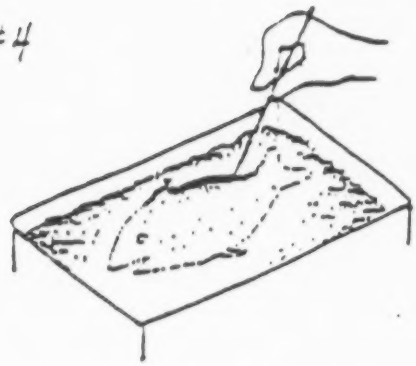
1. Fine beach sand
2. Bucket
3. Plaster of Paris
4. Stick and container for mixing plaster
5. Water
6. Heavy string or a paper clip - to be used as a hanger (optional)
7. Shallow sturdy box or container to be used as a mold
8. Objects to press into the sand for desired shapes
9. Shells, colored beach glass, or pebbles for decoration
10. Spatula, or a piece of stiff cardboard
11. A soft brush (a small water color brush)

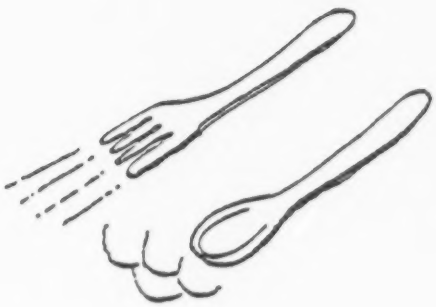


Procedure:

1. Put sand in the bucket and add enough water so that sand is firm but not runny. Mix well.
2. Fill the box or container with sand, packing it tightly and leaving ½ inch of unfilled space at the top of the box.
3. Use a spatula or a piece of stiff cardboard to level the sand in the box.
4. Press objects into the sand to form depressions; or the depressions may be molded with the hands. When the cast is completed, these depressions will stand out from the surface of the cast, forming the design of the finished work.
5. If shells, glass, etc. are to be used as part of the design, or as decorations on the surface of the finished cast, they should be added now. Place shells, glass, etc. face down in the sand. Press down lightly if you wish the shells to be raised slightly off the surface of the cast.

#4





6. Mix the plaster as follows:

   a. For the average sized cigar box, a mixture of about 2 cups water and 2½ - 3 cups plaster powder will be needed.
   b. Pour the desired amount of water into the mixing container.
   c. Add the plaster to the water by sifting it through the fingers or gently shaking it from a can or small cup.
   d. Continue adding the sifted plaster to the water until the plaster builds up in a mound above the surface.
   e. Stir the plaster thoroughly until it is smooth, completely free of lumps, and is about the consistency of heavy cream.
      Note: Stir gently to avoid bubbles.
   f. If mixture is too runny, add more powder, a little at a time. But if mixture becomes too thick or begins to harden before it can be used, throw it away and mix a new batch, because the proper consistency cannot be regained.

7. Carefully spoon the plaster of Paris into the sand mold, filling all the depressions first. If plaster is poured directly from the bowl, the weight will break down the design molded in the sand. So it must be added slowly and carefully.

8. After all the depressions have been filled, and a thin layer of plaster covers the sand, the remaining mixture may be poured carefully into the mold until the plaster is about 1½ - 2 inches thick.

9. While the plaster is still very wet, add a paper clip or a loop of heavy string, knotted at each end, to the top of the plaster cast. This will later serve as a hanger.

10. Allow the plaster to dry for one hour. Carefully remove the plaster sculpture. It will be mounded with sand, and the raised design will not yet be visible. Place it right side up and allow it to dry for another half hour.

11. Take a soft brush and brush the surface of the mold to remove excess sand. Now the design can be seen. The sand still adhering to the plaster gives an interesting texture.

Gyotaku

Japanese Fish Printing

The technique of Japanese fish printing has been used in Japan for over a hundred years to record the sizes and external characteristics of fish and to gain biological information.

The art of gyotaku (pronounced ghio-tá-koo) is a good way to gain an understanding and appreciation of the fine structural details of marine organisms and their great variety. You can also use this technique for making prints of shells, rocks, flowers, etc.

Before making the print, identify the fish. What are its distinguishing characteristics? What is this fish's particular habitat? Afterwards, you might wish to label the finished print with this information, or have the students identify and label the various structural parts of the fish.

You will need:

1. A very fresh fish. Flounders, bluegills, or rockfishes are good to start with. If you buy the fish at a market, select one that has bright red gills, clear eyes, and a fresh smell. If the fish has been gutted, make sure that it has not been cut elsewhere on the body.
2. Newspaper
3. Water-base ink (linoleum block ink is best)
4. A stiff ½ inch brush
5. A very small brush
6. Rice-paper, newsprint, or other moisture-tolerant paper. (Since rice-paper is expensive, you might prefer to start with newsprint)
7. Heavy cardboard from a paper carton.

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Instructions:

1. First, wash the fish with soap and water, and dry it.

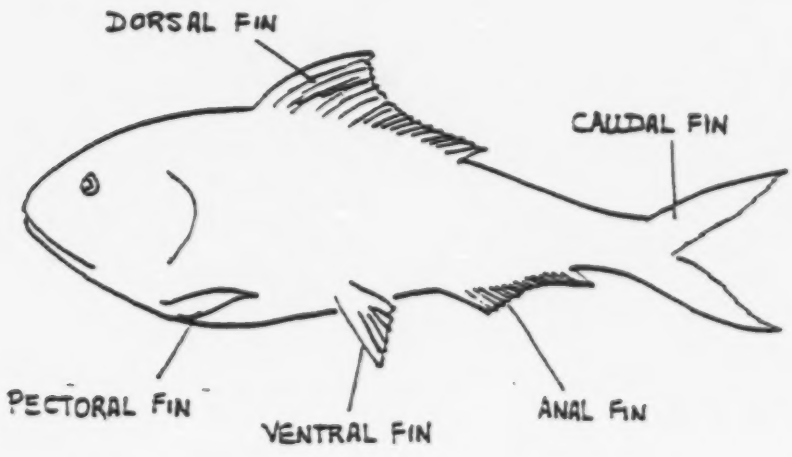
2. Lay the fish down on the scrap newspaper. If you wish, the fins can be opened out and held in place with a straight pin. Lay a piece of heavy cardboard beneath the newspaper and push the straight pin as far as possible into the fin and the cardboard to that it won't be visible on the finished print.

3. Using a stiff brush, brush a thin layer of ink on the fish.

4. Place the paper on top of the fish and carefully press the paper down, without moving it, onto all parts of the fish.

5. Remove the paper and admire the fish print.

6. If you like, you can then paint in the eye of the fish with a small paintbrush.

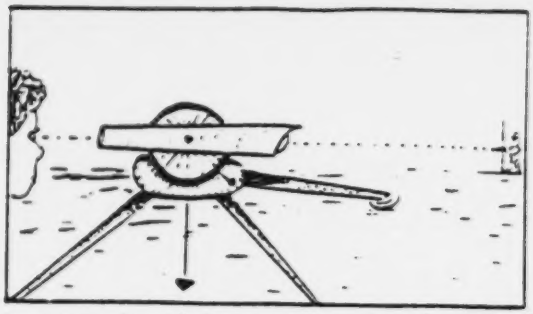


Beach Profiles - Fact Sheet

The beach is always moving. Waves, winds and currents shape the beach and can remove or add many tons of sand to the shoreline each day. Making a beach profile gives you a side view of the shoreline and can help you determine storm and tide water levels. More importantly, you can tell how a beach is changing by making follow-up visits to the same site.

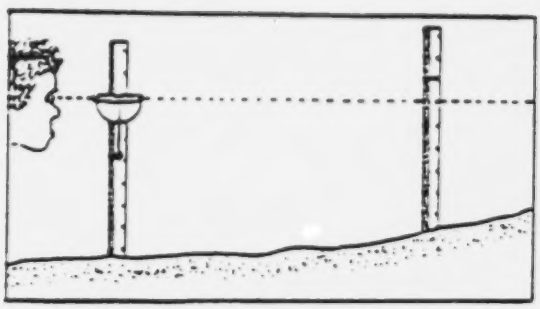
Profiles can be made with expensive and sophisticated optical equipment like a surveyor's transit or simple carpenter's levels. Quick, accurate profiles can also be made with sighting poles and they are easy to make and use. In each case the object is to make a horizontal reference line (visual or actual) across the beach and to take vertical measurements from that line. This will then be your data of changes in elevation as you move from point to point. When these changes in elevation are put into graph form, a side view or "profile" of the beach is made.

A Transit gives a visual reference line to measure from, but is expensive and delicate.



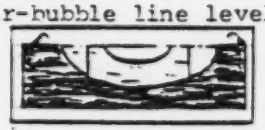
1. Transit with compass, level and plumb.

A Sighting Level does the same thing, only cheaper.

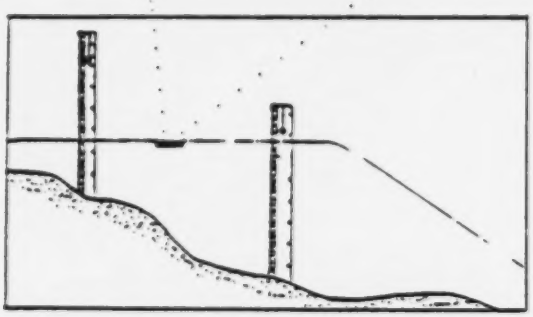


2. Sighting level and plumb.

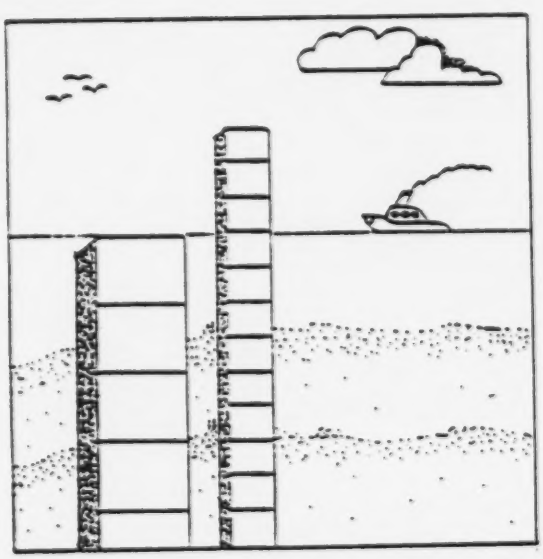
3b. Air-bubble line level



Sighting Poles are inexpensive and can be used with levels and a plumb line to insure accuracy.



3a. Surveying rods with air-bubble line level, plumbs and transect line.



Sighting Poles can be used without accessories if you can see the horizon. This is very accurate if you are careful and make sure your tools are plumb and level!

4. Survey rods. Using the horizon to measure differences in elevation, between two points.

EQUIPMENT

Sighting Poles - can be meter sticks or you can make your own. Poles should fit the students since they will need to "sight" over the top of one pole if levels aren't provided.

Levels - "Carpenter's", "Line" or "Sighting" Levels can be purchased for a few dollars at most hardware stores.

Plumb Lines - can be made with one ounce fishing weights.

Line - between Sighting Poles should be light and smooth twine, which is also available in hardware stores.

VOCABULARY

Bench Mark_____

Elevation_____

Horizon_____

Level_____

Line Level_____

Line (of-sight)_____

Perpendicular_____

Plumb Line_____

Profile_____

Sea Level_____

Slope_____

Transect_____

Transit_____

PROCEDURE

1. Decide on a bench mark and transect line. It should run perpendicular to the shore line and run from the dunes to the water. (Never walk on grassy areas of the dunes!) Draw the line in the sand or lay out a measured line.

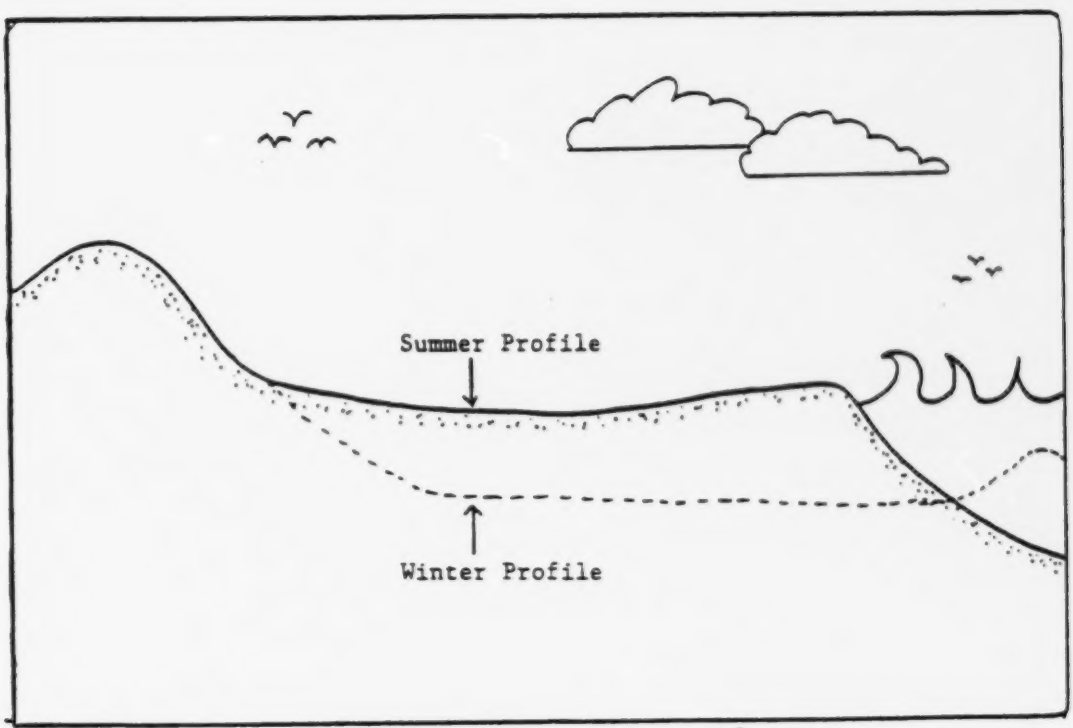
2. Measurements should start on the landward side and work towards the water.

3. Place the forward pole one meter towards the ocean so that both poles are now on the transect line. Using levels or your best judgement, be sure that both poles are "level and plumb".

   Measure the difference in elevation between the two poles using the horizon or the "level line". Be sure to indicate whether the measurement is plus, minus or zero (same elevation). This is position #1.

4. Now move the back pole ahead one meter to position #1. Move the forward pole ahead another meter. Remember to "level and plumb". Take your measurements now at position #2, then continue on towards the beach, one meter at a time.

5. Don't forget to make comments about each position (sand type, debris, grass, etc.). Take measurements as close to the water as possible without getting wet.

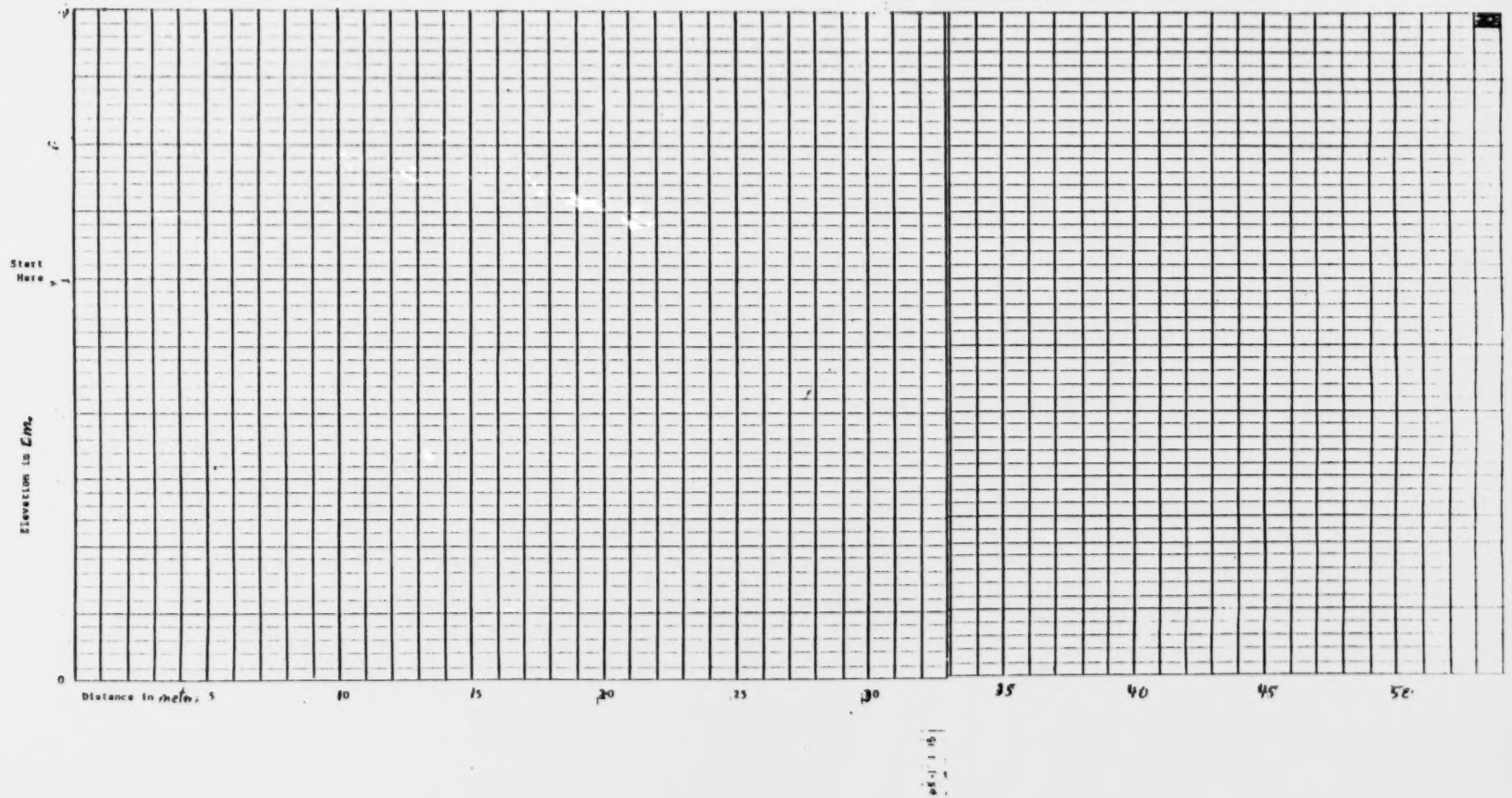


Beach Profile Plotting Sheet

Name _____

Location _____

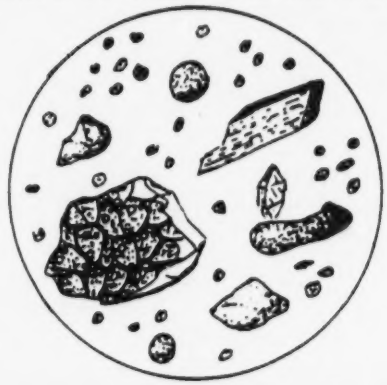
Date _____



SAND STUDIES

A beach is composed of whatever material is deposited there by the waves. The sizes and types of beach material depend on where it comes from and what physical forces act on it.

At Sandy Hook, the beach is composed mainly of quartz, but contains many other materials too. Under a microscope, these particles can be sorted and identified according to their shape and color. Take a dried sand sample from the beach to see how many of these you can identify.



BEACH MINERALS	DESCRIPTION	COLOR
QUARTZ	silicon dioxide	white if pure; but varies in color
FELDSPAR	any of a group of minerals, principally aluminosilicates of potassium, sodium and calcium	pink
MAGNETITE	an oxide of iron	black
GARNET	any of a group of hard vitreous minerals, silicates of calcium, magnesium, iron or manganese with aluminum or iron	varies in color, red is common
TITANIUM	oxide of the heavy metal titanium	dark gray, black

INSTRUCTIONS

Please take a few moments to read all these instructions and only use equipment that you have been trained to use. Instruments like microscopes and balances are sensitive and easily damaged. Carry equipment with both hands, clean it and your area when finished, and put everything away when you have completed your studies.

Equipment Check List

____ Microscope

____ Petri dish

____ Balance

____ Forceps

____ Lights

____ Geological Seives

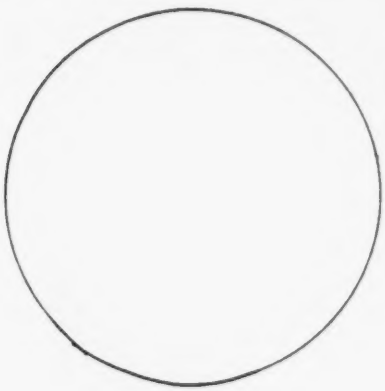
____ Geological Shaker

____ Magnet

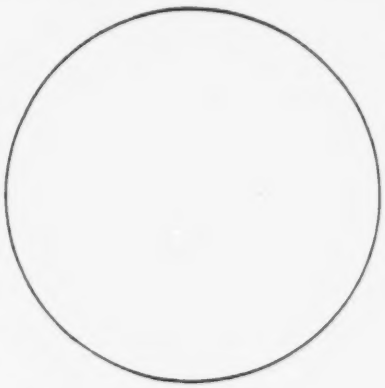
____ Ruler

SAND IDENTIFICATION SHEET

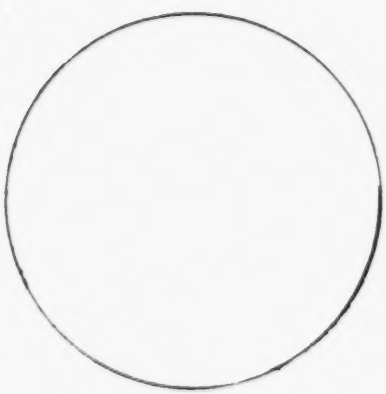
Sand from different areas looks, feels and is different. Carefully analize your samples. Pay particular attention to size, shape, color and transparency.



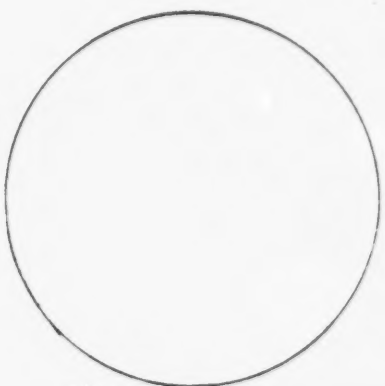
Site _____
Size _____
Major Constituents _____
Minor Constituents _____
_____
_____



Site _____
Size _____
Major Constituents _____
Minor Constituents _____
_____
_____



Site _____
Size _____
Major Constituents _____
Minor Constituents _____
_____
_____



Site _____
Size _____
Major Constituents _____
Minor CConstituents _____
_____
_____

SAND ANALYSIS SHEET

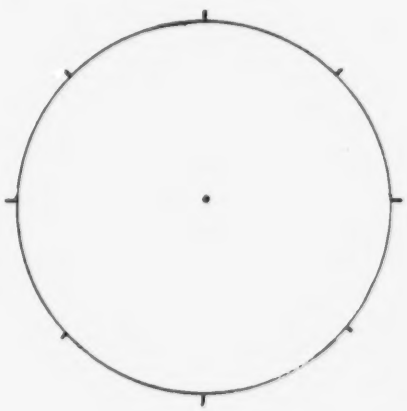
There are several ways that sand can be analized and presented. Take the data you have collected and enter it into the formats below.

Data

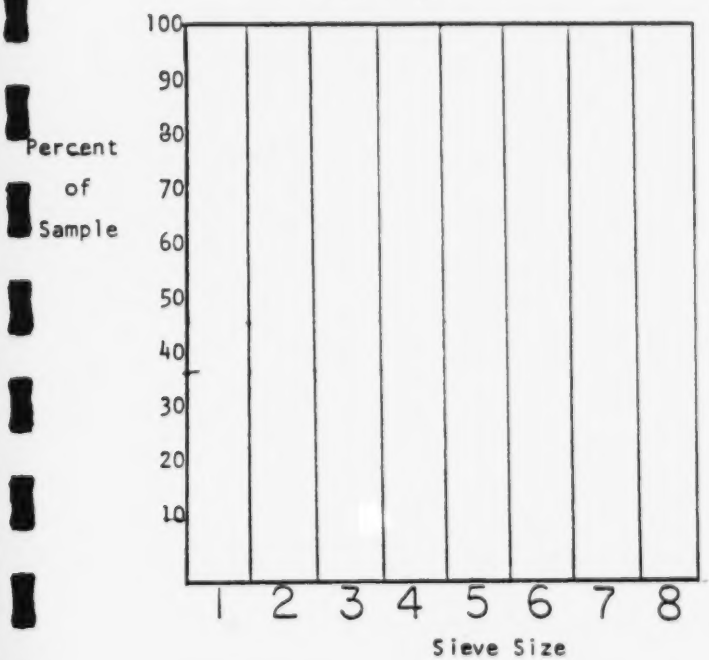
Sieve Size	Weight	Accum.Weight	Percentage
1			
2			
3			
4			
5			
6			
7			
8			

TOTALS

Pie Graph

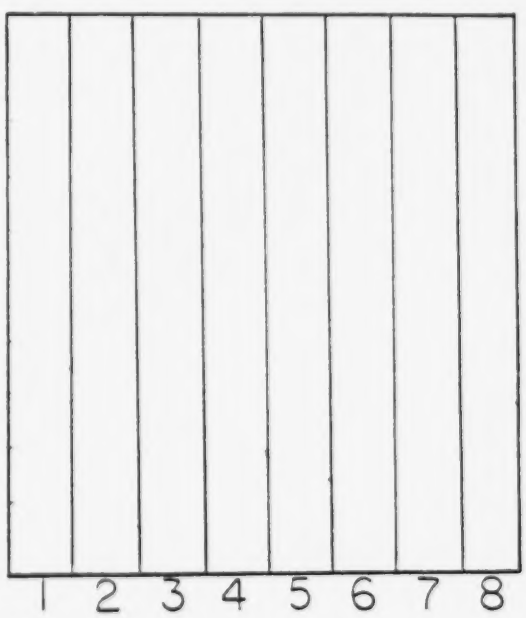


Bar Graph

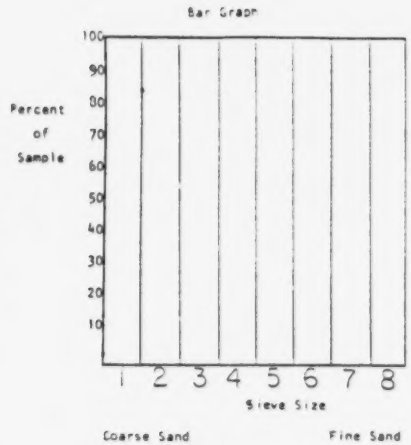


%

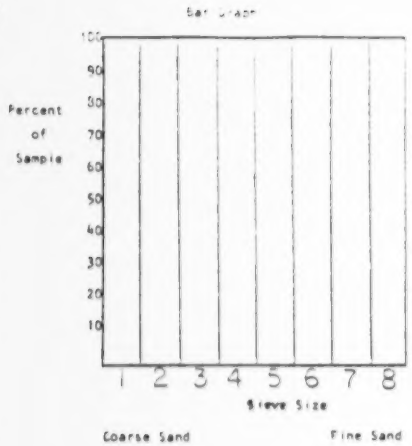
Simple Graph



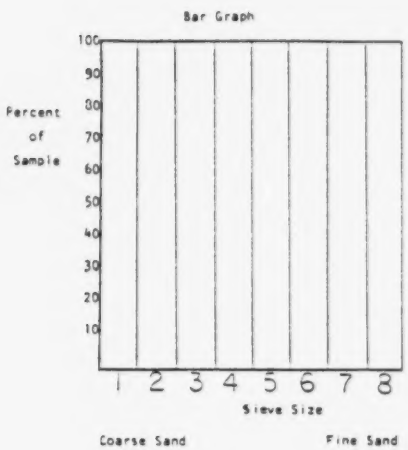
SAND COMPARISON SHEET



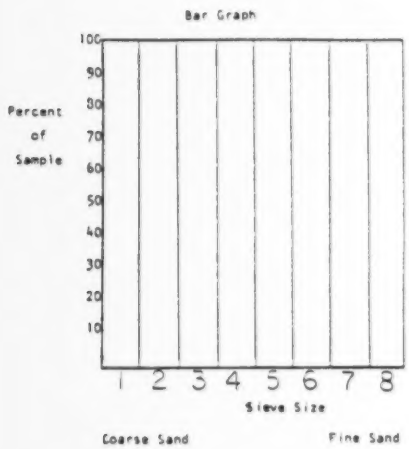
Sand Sample_____



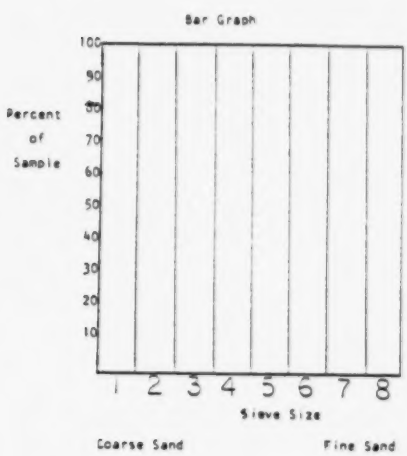
Sand Sample_____



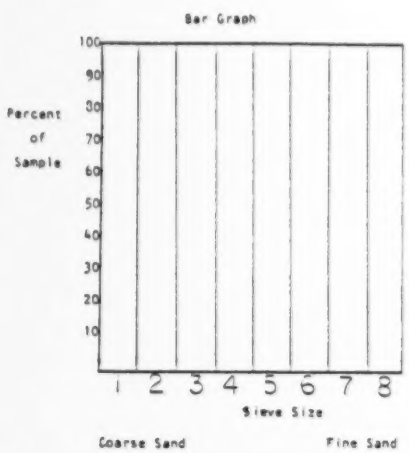
Sand Sample_____



Sand Sample_____



Sand Sample_____



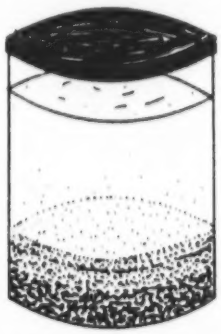
Sand Sample_____

SAND SETTLING EXPERIMENT

Sand particles are of many different sizes, shapes and densities. These particles can differ in settling rates in water and this will affect where they are deposited on the bottom. As a general rule, larger particles settle first and smaller particles take longer to sink to the bottom.

For water to move sand, it must have enough energy to do the work. Therefore, what would take more energy (current speed) to move...a small particle or a large one? What would take more energy to move...a light particle or a dense particle?

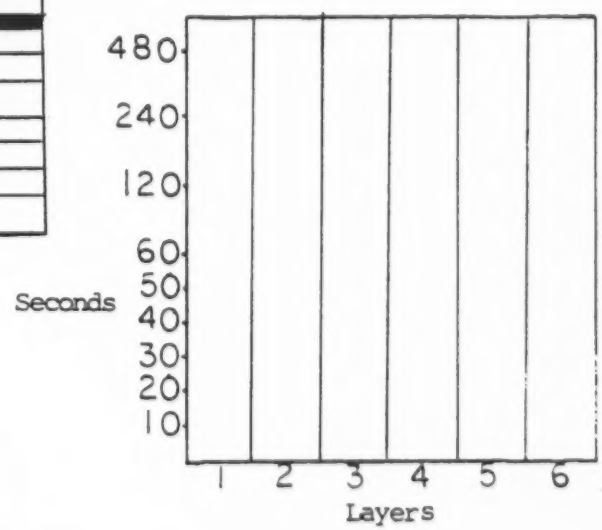
Let's experiment and find out.



1. Fill a straight-sided jar two thirds with water and one third with a sand sample.
2. Close the lid tightly and shake for five minutes.
3. Observe and time the settling rates of the different particles. This may take up to 30 minutes. (Caution: Large pebbles could crack the glass. Remove before you start.)

Measure the amounts of each particle type (constituents) and approximately how long it took to settle. Fill in the data sheet, then complete graph.

Constituent	Particle	Settling Time	Amount	Percent
Layer 6				
Layer 5				
Layer 4				
Layer 3				
Layer 2				
Layer 1				
Totals				



Can you draw any conclusions about the size and types of particles, and their behavior in water. Which are easier for water to move? Which drift longer?

Study this chart. Indicate where these particles might settle on the bottom.(Shore,Deep Ocean). Remember, you need energy to move anything.

Particle	Size MM	Settling Location
Clay	<1/256	
Silt	1/256-1/16	
Sand	1/16-2	
Granule	2-4	
Pebble	4-64	
Cobble	64-256	
Boulder	>256	

Homework

1. Write a "geologists" description of your sand sample. Use terms that were discussed in class. (Crystal, Plished, Fine, Course, Transpatent, Opaque, etc.)

2. Analize soil or sand from your neighborhood. Compare it with what you analized here today.

ROCK IDENTIFICATION KEY

IGNEOUS ROCKS

TEXTURE	COLOR	
	LIGHT	DARK
LARGE CRYSTALS	GRANITE	GABBRO
SMALL CRYSTALS	RHYOLITE	BASALT
NO CRYSTALS	PUMICE (gas bubbles)	OBSIDIAN (glassy)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

SEDIMENTARY ROCKS

MADE OF:	NAME
pebbles gravel	CONGLOMERATE
sand	SANDSTONE
mud	SHALE
parts of sea animals and plants	LIMESTONE

7. _____
8. _____
9. _____
10. _____

METAMORPHIC ROCKS

APPEARANCE	PARENT ROCK	NAME
tightly layered	shale	SLATE
mica layers	sedimentary rocks	SCHIST
light and dark stripes	granite	GNEISS
glued sand grains	sandstone	QUARTZITE
compact crystals	limestone	MARBLE

11. _____
12. _____
13. _____
14. _____
15. _____

Vocabulary--WAVES

Beaufort scale - a scale of numbers that relates the speed of the wind to the size of waves observed on the open ocean.

breaker - a wave in which the crest has fallen off.

crest - the uppermost part of a wave.

feeling bottom - when waves move into water shallower than ½ their wave length causing the lower part of the circular motion of the water particles to slow down due to friction with the bottom.

fetch - the distance of water over which the wind can blow. One of three factors that determine the size of wind waves.

littoral drift - the movement of sand along a beach because of longshore current.

longshore current - current of water that moves along a beach caused by waves breaking at an angle with the shoreline.

plunging breaker - a breaker in which the crest is thrown off into the trough ahead.

rip current - water current formed when water moves to sea through a break in an offshore bar.

spilling breaker - a breaker in which the crest slides down itself into the trough ahead.

surging breaker - a breaker in which the crest does not fall over into the trough ahead.

swell - a wave that has moved out from under the wind that formed it.

trough - the low area of a wave between two crests.

tsunami - a seismic wave that may reach great heights. Giant sea waves caused by earthquakes, volcanic explosions, and other disturbances of the sea floor.

wave height - the vertical distance between a wave trough and a wave crest.

wave length - the horizontal distance between two crests.

wave period - the time that elapses between the passing of two wave crests.

wave refraction - the bouncing of waves off the shore or other obstructions. The angle of reflected waves depends on the angle of the approaching waves.

wave diffraction - the curving of waves when they pass between obstacles.

Vocabulary--TIDES

Apogee - the point in an elliptical orbit where the orbiting object is at the greatest distance from the object being orbited.

Centrifugal force - outward force exerted by a revolving body away from the center of revolution.

Diurnal tides - a tidal cycle of one high and one low tide about every 24 hours and 50 minutes, one lunar day.

Ebb tide - the tide associated with the decreasing height of the tidal cycle, the outgoing tide.

Flood tide - the tide associated with the increasing height of the tidal cycle, the incoming tide.

Gravity - the attractive force which masses exert on each other.

Lunar day - the amount of time it takes the earth to rotate so that the same spot on the earth is lined up with the moon before and after the rotation, about 24 hours and 50 minutes.

Mean low tide - the average height of the water at low tide.

Neap tides - tides that have the least variation of water level between high and low. Neap tides occur when the sun, earth and moon form a right (90 degree) angle with each other i.e. when the moon is in its quarters.

Perigee - the point in an elliptical orbit where the orbiting object is at the least distance from the object being orbited.

Semidiurnal tides - a tidal cycle of two high and two low tides about every 24 hours and fifty (50) minutes, a lunar day. There is little difference in the magnitude of two successive high and low tides.

Slack tide - the state of the tide when tidal current velocity is near zero.

Spring tides - tides that have the greatest variation of water level. Spring tides occur when the sun, moon, and earth form a straight line, with a full or new moon.

Tidal currents - movements of water in response to the tides.

Intertidal zone - that part of a coastline that is underwater at high tide and exposed at low tide.

Mixed tides - semidiurnal tides that have a difference in the magnitude of successive high and low tides.

Vocabulary

Barrier Island: An island separated from the mainland by a narrow body of water or by a shallow, often marshy area.

Estuary: The place where a river meets the sea.

Inlet: An opening in a barrier island that connects the sound or the lagoon with the ocean water.

Marsh: An area of soft wet land periodically flooded by the tide, typically found in a low wave energy area behind an island or in estuaries.

Spartina: A hearty, salt-tolerant grass.

Dune: A mound of sand built by the force of the wind.

Overwash or Washover: A process whereby waves washing over an island carry sand from the sea side to the land side.

Blowout: For sand dunes it refers to the situation when winds move sand to create an unstable moving dune in an area previously stabilized by plants.

Beach: That portion of the shoreline from the berm to the nearshore sand bars.

Berm: A terrace of sand found at the highest tide point where waves have either deposited sand or eroded a little cliff.

Jetty: A structure built to influence the movement of currents in order to maintain channel depths at the entrance to harbors.

Longshore Current: The current in the surf zone moving parallel to the shore, which is generated by waves breaking at an angle with the shoreline.

Littoral Transport: The longshore current carries sand along the shoreline, and may deposit it at one end of an island, thereby extending that end.

Bar: A submerged mound of sand.

Breakwater: A sea wall of rock, concrete, etc., built to absorb the impact of waves and thus protect the shore behind it.

Sound: The body of water that lies between an island and the mainland.

Spit: A small penninsula-like point of land projecting into the water from the shore.

Sediment: Small bits of worn away rocks and decayed organic materials that are transported by wind and water.

Coastal Ecology

Vocabulary

Nutrients: Chemicals needed to support plant and animal growth; the main plant nutrients are phosphorus and nitrogen.

Buoyancy: The tendency of an object to sink or float.

Ecosystem: A community of organisms interacting with each other and the environment in which they live.

Filter Feeder: Any organism which actively filters suspended material out of the water column by creating currents. Examples are oysters, herring, baleen whales.

Plankton: Small organisms which drift with the current.

Zooplankton: Tiny animals floating in the upper water column feeding on phytoplankton.

Phytoplankton: Tiny plants floating in the upper levels of the ocean where sunlight penetrates.

Bioluminescence: Light emitted from organisms by physiological processes. Luminescence in marine organisms is probably an adaptation for recognition, swarming and reproduction.

Photosynthesis: A process in plants by which energy - rich organic compounds are made from water and carbon dioxide using sunlight as an energy source.

Productivity: The amount of organic material formed in excess of that used for respiration. It represents food potentially available to consumers.

Diatom: A single-celled organism that is a type of plankton. Diatoms are one of the most nutritious food sources for animals in the sea.

Dinoflagellate: A single-celled organism that is a type of plankton. Nearshore plankton caught with plankton nets are mostly diatoms and dinoflagellates.

Nekton: Actively swimming animals, such as fish.

Benthos: Organisms living on the bottom of the ocean, eg. crabs and worms.

Benthic: Having to do with the ocean bottom.

Dessication: The tendency to dry up when removed from water for a period of time; this factor is extremely important for sea-dwelling crustaceans (ghost crabs, sand fleas, etc.) which must return to the ocean for water--these animals need water to moisten the gill-like lungs which they possess.

Littoral: Referring to the region along or near the shoreline. The intertidal zone.

Fauna: The animals of a given region.

Epifauna: Animals living on the ocean bottom, either attached to it or moving freely over it, such as crabs.

Infauna: Animals which burrow into sand or mud, such as clams.

Vertebrate: An animal that has a backbone or spinal column.

Invertebrate: An animal that does not have a backbone or spinal column.

Biota: Plants and animals of a given region.

Niche: The position of an organism in its community, defined by what it does (its profession -- herbivore, carnivore, scavenger, etc.)

Substrate: The base on which a plant or animal lives. For example, barnacles attach to hard substrates like pilings while lugworms prefer soft substrates like sand flats.

Zonation: The distribution of organisms typical of a particular area.

Brackish: Less salty than the ocean, but saltier than fresh water; estuaries are brackish because fresh river water mixes with salty ocean water.

Habitat: The particular place where an organism lives; salt marshes are one kind of habitat, beaches another.

COURSE EVALUATION

COMMUNITY SERVICES

BROOKDALE COMMUNITY COLLEGE

COURSE TITLE_____SEMESTER_____

PLEASE ANSWER THE QUESTIONS YOU BELIEVE TO BE RELEVANT TO THE SESSION(S) YOU ATTENDED.

1. Underline appropriate word(s)

   a. The instructor (was) (was not) well prepared.

   b. There (was) (was not) enough time for discussion by class participants.

   c. The discussion (was) (was not) well moderated by the instructor.

   d. The session (met) (did not meet) my expectations.

   Please comment on any of the above:_____

   _____

   _____

   _____

2. What I liked best about the program was:_____

   _____

   _____

   _____

3. What I liked least about the program was:_____

   _____

   _____

   _____